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REPORT ON DIGITAL HEALTH PROJECT

THE RISING INCIDENCE (AND RELATED FACTORS) OF HYPERTENSION ACROSS THE TEN REGIONS IN GHANA. (AUGUST 2023)

DISCLAIMER: DATA USED IN THIS PROJECT WAS SELF-GENERATED AND THUS DOES NOT TRULY REPRESENT A REAL-LIFE SITUATION.

1. USE CASE – SPECIFIC PROBLEM DESCRIPTION / STAKEHOLDERS INVOLVED

   Non-communicable diseases remain one of the biggest challenges of public health, with an increasing prevalence across the world. In Ghana, hypertension silently affects millions of Ghanaians, and poses a significant threat to individual and national health. Studies have shown that one in every three adults in Ghana has hypertension and these rates may even be high in the urban areas. Also, underdiagnoses of hypertension is as high as 80%, and among those diagnosed, only one in five has their condition under control.

   Hypertension is the leading cause of death in Ghana, and contributes to other morbidities such as heart disease, kidney failure and stroke.

   Unhealthy diets lacking fibre, high salt intake, physical inactivity, excessive alcohol consumption and tobacco use are risks associated with lifestyle. Social determinants include poverty, limited access to healthcare, and inadequate education, and the rapid urbanization has lead to an increased exposure to risk factors and stress.

   The consequences of hypertension are devastating, both to the individual and the economy. Hypertension causes physical and emotional suffering, disability and reduced quality of life. Also, the illness leads to lost productivity and workforce participation, and the cost of treating hypertension and its complications consequently puts a significant strain on the healthcare system and the economy.

   STAKEHOLDERS

   - MINISTRY OF HEALTH – leads national disease control strategies and allocates resources for programs.
   - LOCAL HEALTH AUTHORITIES – implement surveillance activities at the community level, collect data and coordinate public health interventions
   - HEALTHCARE PROFESSIONALS – measure blood pressure during hospital visits, diagnose and manage hypertension. They also report cases to authorities.
   - ACADEMIC AND RESEARCH INSTITUTIONS – they train healthcare professionals on hypertension and conduct studies on hypertension – prevalence, risk factors, interventions, informing evidence-based policies.
   - PHARMACEUTICAL AND MEDICAL DEVICE COMPANIES – they develop medications for treatment of hypertension, and manufacture devices for blood pressure monitoring.
   - INTERNATIONAL ORGANIZATIONS (WHO) – provides technical guidance, resources, and training for countries to strengthen their hypertension surveillance and management systems, and collects country-specific data for analysis and reports on a global scale.

A good data visualization tool can be a powerful asset for all stakeholders mentioned above, by addressing various challenges and promoting effective communication and collaboration.

2. PATHWAY TO FINDING A SLOUTION

Interactive visualizations are becoming a popular and innovative way to handle data. They provide a picture of current trends at a glance and make it easier to spot problem areas, prompting further investigation. There is also the function of real-time monitoring on maps/charts to enable stakeholders to make timely and effective decisions and interventions. Visualization tools create a common language for stakeholders, making communication and collaboration better, and help analyze complex datasets to identify patterns and correlations.

The data set used in this work focuses on data such as age, gender, new cases, body mass index, occupation and level of education. The purpose for selecting these basic demographics is to determine the age of onset or diagnosis of hypertension, and how it evolves over years, the incidence across the regions and what region-specific factors may be contributing to it, and how social factors such as occupation, level of education, and lifestyle-associated risks such as body mass index influence the development of hypertension in a person and access to and compliance on treatment medication.

The data set used in this work was self-generated, and as such does not represent a real-world situation. It was cleaned in R Studio, and analyzed to give results such as the incidence per region, the age distribution of the new cases, the gender distribution, the BMI trends in the new cases, and the proportion of new cases on treatment. Information derived from this visualization can be used to make hypertension surveillance more effective, and target problem areas that need intervention.

3. IMPLEMENTATION

- I initially tried to find a suitable dataset on *kaggle.com,* but after searching for a while and finding none, I explored other sources.
- The dataset was eventually generated using *mockaroo.com* tools. Column descriptions were stated and then the cells were randomly populated with data.
- The dataset was downloaded and saved as a *.csv* file in Microsoft Excel.
- The R Studio application was installed on my computer, and all packages installed as well.
- I created a new file in R Scripts called DIGIHEALTHFILES.R
- The dataset was then imported to R Studio for the analysis to begin.
- With the help of the internet, I was able to get sample R codes for the various graphs/visualizations I wanted to produce, and then made necessary adjustments to them. Since codes are very sensitive to characterization and names in the dataset, this part was a little challenging as some codes kept running into errors that had to be corrected. The right codes were eventually obtained after many tries. I used *ggplot* and *geom* packages for the work in R script, to produce static graphs.

- I then installed the shiny app package in R, and this allowed me to create a dynamic visualization in Shiny App. The Age Distribution visualization enables the user to have a filtered or more detailed look at the graph displaying the ages of the new cases, selecting the age ranges preferred. I also created another app to visualize the number of cases per region.

- Next, I created an account on shinyapps.io and used the token and secret code to publish and deploy my app on a shiny webpage with a working URL. The second app which contained the visualization on the number of cases per region, however failed to be published. An error message saying "an error has occurred, check your logs or contact the app author for clarification" kept appearing on the web page.

CHALLENGES

- During my work, I came to realize that it was easier to work in R studio with data that was predominantly made of numbers, as opposed to texts. As a result, I had a hard time producing some graphs and eventually had to assign numbers to certain entries in a column to be able to run the codes.

- I ran into so many errors while running the codes and for some, it took hours to identify the problem and correct it.

- I had problems with installed packages – ggplot2, dplyr – which required me to reinstall them multiple times in order for the codes to run, and also I had to uninstall and reinstall the RStudio app a few times. However this problem persisted.

- Challenges with publishing on shinyapps.io. An initial publishing of one visualization was successful, but the subsequent publishing of a second one failed, with the following error message.

  However, the code runs well, and the app runs, displaying the visualization.

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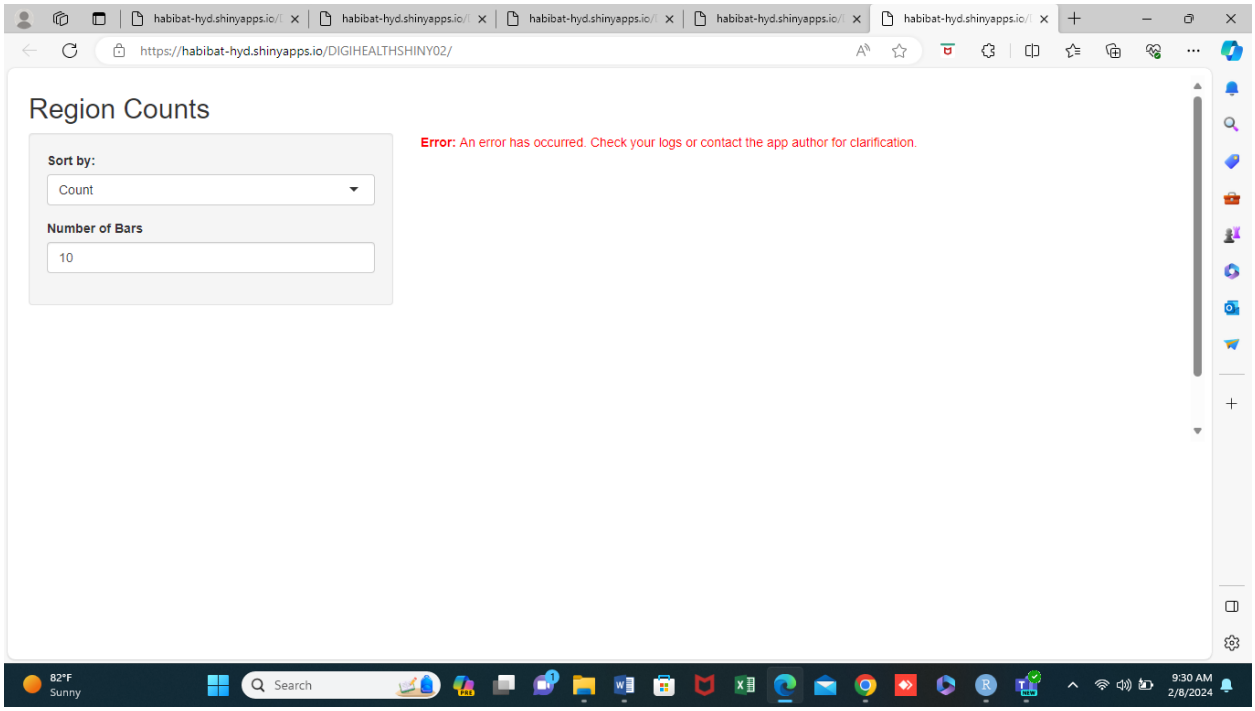

The local web page is running, as indicated on the Dashboards on shinyapps.io, however the information is unable to be displayed.
Attempts at the suggested routes to resolve the error were unsuccessful.